Gender differentials in agricultural productivity: evidence from Nepalese household data

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Abstract

This study analyzes productivity differentials between men and women in the peasant agriculture in Nepal. Both Cobb-Douglas and translog production functions are estimated using data from the Nepal Living Standard Survey 2003/04. Evidence is found for higher value of marginal product of adult family male than adult female, while marginal products of other inputs are found to be relatively higher than the prevailing market wages and prices, implying that these inputs have become gradually a binding constraint in production. Male managed farms produce more output per hectare with higher command in market input use, obtaining credit, and receiving agricultural extension services than female managed farms. In contrast, the result does not clearly support the hypothesis of separability or aggregation of male and female labour, but there is little justification of weak separability. Moreover, head's sex as proxy for farm manager does not show any difference between male and female managed farms. However, the coefficients of location and household characteristics show significant variations in farm output among ethnic and caste groups residing in different ecological belts of Nepal. Overall, adult male labour is found to contribute more in production process than adult female labour.

Keywords: gender differentials, agriculture, production functions, marginal products, Nepal.
JEL Classifications: Q12, J16, J24.

1. Introduction

The issue of gender differentials in relation to farm productivity in subsistence farming has been of special interest from the standpoint of public policy in developing countries, as the difference is often viewed from the angle of human capital theory and measurement of discrimination. The role of rural women in agricultural development draws not only the attention to the academicians but also to the politicians, assuming that gender equality does matter for overall economic development and welfare measurement. On academic arena, gender differences are often discussed with non-homogenous characters and gender specific constraints that might vary in the

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productivity of men and women. The literature in this perspective shows that yield differences between male and female are due to gender-specific constraints such as land, labour, access to inputs (i.e. fertilizer, modern variety of seeds, oxen and other farm equipments) and credit faced by female managed farms in comparison to male managed farms[1]. Such differences in Nepal are also explained by disparities in physical and human capital, originating from economic and socio-cultural discriminations[2] (i.e. gender and caste or ethnicity disparities).

Gender gaps in terms of labour market participation in the agricultural sector are common phenomena in many developing countries, where the determination of wage rates may be influenced by various factors such as size of population, level of urbanization, and the condition of physical infrastructures in the particular region. Such variation in wage rates may limit the labour market participation that often leads to gender discrimination in the labour markets. An understanding of such variations as well as discriminations is a matter of interests among economists and policy makers in order to find the extent of gender differentials in farm productivity.

The measurement of gender differentials in farm productivity requires wide level of data set, particularly the information related to plot level data managed by both men and women separately. However, such information is not so common in the South Asian region, where men are considered to be the head of household regardless of their role in farm investment decisions. It is also true that men are the main decision maker for investment, as by Nepalese culture and tradition; men have inherited property rights of land and other assets in the household. On the other hand, women are normally supposed to be a household head only in the absence of their male counterparts, either due to the death of their husband or seasonal migration for wage work. The conventional method to measure technical efficiency between male and female in farm productivity is the estimation of pooled regressions by different production functions (e.g., Cobb-Douglas, Leontief and Translog) with a dummy variable of the sex of household head (or farm manager). The sign of the sex dummy normally explains the gender differentials in farm productivity. However, technical efficiency measured by the sex dummy may not imply allocative or economic efficiency (Urdy et al. 1995).

Moreover, gender gaps are also viewed with the differences in earnings and wage rates observed in the labour market. This difference is often explained by the absence of perfect labour market that is likely to vary in the returns to schooling. Wage variation between men and women is

[1] Udry (1996) observed that gender specific constraints were higher in female managed plot in Africa which could lower productivity of female headed.

[2] In Nepal, economic and cultural as well as caste discriminations play major role in labour market participation, wage rate determination, and farm productivity, particularly in rural households where subsistence farming is dominant form in the agricultural sector (Thapa 2003, 2004 and 2008).

pervasive in most developing countries, and the literature observed imperfect substitutes between family and hired labour as well as male and female labour in most part of farm households[3].

In order to measure gender differentials in farm productivity from the labour markets, indirect approaches such as wage or earning functions of male and female participated in the labour markets are used with taking into consideration the individual characteristics of men and women in the farm labour, which provide the returns to schooling for men and women. The difference in the returns to schooling is considered as the gender differentials in productivity. In addition to this, the model such as adoption of technology is also frequently applied to measure the productivity differences by gender, assuming that the adoption of new technologies is likely to vary between men and women, leading to the differences in farm productivity. However, this paper applies only production functions for the estimation of gender differentials in farm productivity.

A large number of studies have so far been done on gender differentials in farm productivity. For instance, Kumar and Hotchkiss (1988) applied translog production functions for various crops and tested separability between men and women in Nepal. They found some evidence of significantly independent marginal products of men and women, but separability test shows that there is little justification for aggregating men's and women's labour. Jacoby (1992) estimated both Cobb-Douglas and translog sequentially restricted production functions in Peruvian Sierra and found a higher productivity for men than women. However, a significantly higher productivity of women is found in livestock production functions. Moreover, Quisumbing (1995) reviewed a number of studies related to male and female managed farms or plots, mostly applying Cobb-Douglas production functions that assumed a homogenous technology within the country. These studies used a dummy variable of head's sex as proxy for farm management, assuming that the significant of sex dummy supports the argument of socio-cultural discrimination between male and female workers in the agricultural sector. However, only two out of ten studies were found to be statistically significant with wrong sign. These studies found that male managed farms were more productive than female managed farms. A study done by Urdy (1996) using agronomic panel data set from Burkina Faso explored a higher yields controlled by men than women in similar plots within the household planted with the same crop in the same year. The World Bank policy report (2001) entitled 'Engendering Development' explains that internationally, women-headed households and women-cultivated plots have produced lower yields and revenues.

This paper attempts to explore the productivity differentials between men and women, assuming that women are relatively less productive than men, particularly in subsistence farming using production functions both Cobb-Douglas and translog (Transcendental Logarithmic). The

[3] Jacoby (1992) shows that women's and men's labour are not perfect substitutes in Peru, followed by Abdulai and Regmi (2001) and Thapa (2003) observed same results in Nepal.

intuition behind this argument is due to cultural differences and comparative advantages for men, as a male-dominated society, women are restricted to carry out some farm works such as ploughing the land. On the other side, women are supposed to be specialized more on labour intensive works such as seed selection, planting, weeding, and application of organic manures (Thapa 2003). This allocation of farm works has also set up the different wage rates as well as the nature of job between men and women in most part of rural Nepal. In addition, women have relatively less access to property rights of land and other household assets that may limit investment decision and innovation in the agricultural sector.

The remaining part of this paper is organized as follows: after describing the data and descriptive statistics in Section 2, Section 3 deals the models used in this paper to measure gender differentials in farm productivity. Section 4 then explains empirical results both production functions and finally summery of findings are presented in Section 5.

2. Data and descriptive statistics

The data used in this analysis is obtained from the Nepal Living Standard Survey 2003/04 (NLSS II) of the Central Bureau of Statistics, Nepal. The methodology used in the survey was applied more than 50 developing countries by the World Bank with the purpose of the Government to monitor progress in improving living conditions and to evaluate the impact of government policies and programs in the country. NLSS II is the second national survey of Nepal conducted by the Central Bureau of Statistics, Nepal with technical and financial cooperation from the World Bank. The survey was applied two-stage sampling procedure to select the sample for the first stage of the survey (e.g., NLSS 1995/96), in which the smallest administrative unit (i.e. the ward of Village Development Committees) was considered as the primary sampling unit (PSU) for the survey.

The NLSS II was selected 275 wards with probability proportional to size (PPS) from each of the four ecological strata, where size was measured from the number of households in the ward. For NLSS II, the number of households in each PSU was fixed such as twelve. The total sample size was 4008 households. However, only 3912 households consisting of 408 households from mountain; 1968 households from hills; and 1632 households *Terai* (the southern plain) were enumerated because of insurgency during field survey. Out of 3912 households, this study uses only the 2360 households, in which at least one female and male member worked on the family farm.

NLSSs provide a large number of data set about agricultural activities including the information of demographic characteristics, household activities both farm and off-farm, education and literacy, employment status in both farm and off-farm, wage rates and remittances covering all

administrative and ecological zones. For the purpose of this study, information includes the time allocation of household members on farm, various income sources, and other household and location characteristics.

Descriptive statistics of the data used in this paper are given in Table 1. Total farm income is the income received from farm products, by products of animal and farm, and income from livestock measured in Nepalese Rupees. Total farm land is the land used by the household for agricultural activities either owned, or rented, or sharecropped during the survey year and measured in hectare. Irrigation ratio is considered as the measurement of land quality which is common in these exercises. The variable for cash input is the sum of household expenditure on various items such as irrigation, transportation, seeds, and other farm equipments. In subsistence farming, households often used their traditional inputs for cultivation, so that the cash input is added in one variable due to low expenditure of market inputs. However, the expenditure on inorganic fertilizers is considered as separate variable for the analysis. Labour input is divided into three categories: adult family male and female, and hired labour that includes both hired and exchange labour. The data also provide the information of livestock value and the number of livestock in the sample households.

A number of variables representing the household and location characteristics such as sex, age and schooling of household heads and households belonging to caste group, are included as proxy for management input. Moreover, the dummy variables for each ecological belt are also included in the production function, assuming that such variables do matter due to variations in access to markets, proximity to roads and other resources.

3. Econometric specifications

The conventional method estimating the marginal productivity of inputs such as land, labour, and capital is to employ either male and female productions functions separately or to estimate a pooled regression with gender dummy considering as farm manager or household head (Quisumbing 1996). However, the literature often explains that production function approaches to estimate labour productivity only show the technical relationship between inputs and output specifying the maximum level of production under the available level of inputs, and refer also the productivity of an additional unit of labour. The common practice to analyse gender differentials in technical efficiency is to use the Cobb-Douglas production function, which is as follows:

$$(1) \qquad \ln Y_{ih} = \sum_{j=1}^{n} \beta_j \ln X_{jh} + \sum_{t=1}^{k} \gamma_t D_{it} + u_i ,$$

where Y_{ih} is the total value of agricultural output produced by farm manager i in household h. X_{jh} is the quantity of input j used by farm household h, whereas D_{it} is the vector of the location dummies that represent some household and location specific characteristics. β_i's and γ_i's are the parameters to be estimated and u_i is an error term summarising the influence of other omitted variables. Cobb-Douglas production function, despite a convenient to estimate, is more restrictive form that assumes strong separability between inputs and elasticity of substitution equal to 1.0. Other less restrictive approach using Taylor's expansions such as translog production function is one of the best alternatives to estimate gender differentials. This production function is considered as more flexible functional form in comparison to Cobb-Douglas production function. The general form of the translog production function can be written as;

$$(2) \quad \ln Y = \alpha_0 + \sum_i \alpha_i \ln X_i + \frac{1}{2}\sum_i \sum_j \alpha_{ij} \ln X_i \ln X_j + \omega_i ,$$

where, Y is the total output. The parameter α_0 refers as the state of technical knowledge and α_i and α_{ij} are technologically determined parameters, and ω is an error term. The estimates from the translog production function are used to calculate marginal product (MP) of factor inputs. The MPs of adult family male and adult female labour inputs are also tested whether both male and female labour inputs are homogenous. On the other hand, separability assumption means that marginal rates of substitution between pairs of factors in the separated groups are independent of the levels of factors outside that group (Denny and Fuss 1977). In this paper, the translog production function is presented as follows,

$$(3) \quad \ln Y = f\left(\ln L_t (L_{hm}, L_{hf}), \ln X_i\right),$$

where L_t is total family labour input, L_{hm} and L_{hf} are adult family male and female labour respectively, while X_is are other inputs such as land, hired labour, fertilizers, and other cash inputs. $f(lnL_t, lnX_i)$ is assumed to be linear in lnL_t and lnX_i, and the function will be in quadratic form, if the labour inputs of male and female (lnL_{hm}, lnL_{hf}) are considered separately. The equation can test separability assumption (i.e. the homogeneity of male and female labour with other inputs) by applying the following constraint,

$$(4) \quad \ln L_{hm} \cdot \ln X_i = \ln L_{hf} \cdot \ln X_i = 0 ,$$

the translog production function is assumed to be linear of both family labour and other inputs as declining marginal product for both, then the coefficient of squired terms are set equal to 0 (Kumar and Hotkiss 1988). The production function then remains as follows;

$$(5) \quad \ln Y = f\left(\ln L_i, \ln X_i, \ln L_i \cdot \ln X_i\right),$$

where L_i is labour input of adult family male and female and X_i is other inputs as described above.

The production functions such as Cobb-Douglas and translog are often encountered with the problem of not allowing any of the inputs that take zero value. A number of households are reported zero on hired labour inputs and other cash inputs, either because they have enough family members for labour input on their farm, or they do not have enough liquidity to hire labour as well as to apply other cash inputs. There are several possible ways to avoid the problem of log of zero: one solution is to delete all those respondents who reported zero input and keep only positive response; the second option is to throw out the variables from the regression analysis; and the third option is to add constant in the inputs by keeping intact of the original form of the production function. The last option seems to be most palatable. Based on the method applied by MaCurdy and Pencavel (1986) and Jacoby (1992), the constant one is added to all input variables except farm land and family labour, which are always positive by construction of the sample. This option of adding one is arbitrary, assuming that it is closed to zero, or at least small relative to the average input value.

3. Empirical results

Table 2 displays the average output and input per hectare used by male and female headed households with an aim to demonstrate the difference in farm productivity. The results show slightly higher average farm output per hectare in male headed households (NRs. 24617.05) in comparison to female headed households (NRs. 24528.51). However, input use per hectare is found to be a mixed result. For instance, male headed households applied relatively more work hours of family male labour, while female headed households used more work hours of family female on the farm. Moreover, work hours of hired labour are found to be higher in female headed households. On the contrary, male headed households spend more on fertilizers and other inputs bought from the markets. In terms of access to resources, male headed households obtained more credits and received higher average agricultural extension services than their female counterparts. This result indicates that male headed households have relatively better access to resources, particularly in access to new varieties of seeds, inorganic fertilizers, agricultural extension services, and farm credit.

The estimated parameters of the Cobb-Douglas production function is presented in Table 3. The production function is applied on the reduced sample of 2360 households with a dummy variable of female heads as a coefficient of gender differential in technical efficiency. The coefficient of R^2 (0.51) shows that 51 percent of the variations in the farm output is explained by the included variables, combined with the significant of F-ratio which implies the data fits the model. The estimated coefficients are found to be significant with expected signs. For instance, dummy variable of female headed households is negative, but not significantly different from zero,

implying that gender does not have impact on production process at least in this model. Land is found to be an important input in the production process, in which households with higher ratio of irrigated farm land can have higher productivity. The results further show that adult family male labour (0.08) has relatively higher role in production process, followed by adult family female labour (0.07) and hired labour (0.05). This result is in line with the result of Abdulai and Regmi (2000) and Jacoby (1992), but is in contrast with the result of Thapa (2003), Udry et al.(1995), and Skoufias (1994). Higher expenditure on fertilizers and other market related inputs also leads to higher farm output in Nepal. The result also shows significant and positive effect of the number of livestock, implying that larger number of livestock is more likely to increase farm productivity.

The results of other household characteristics are found to be important in farm production process. For instance, head's education has positive impact on farm production. It is perhaps due to higher access of information and other resources in comparison to less educated people, confirming the widely accepted role of human capital toward improving farmers' efficiency (Abdulai and Huffman 2000). This result also supports with the coefficient of the so-called higher caste dummy, in which there is significant impact on farm production process, if the household belongs to the so-called higher caste than the so-called lower caste, which is compatible with the result of Thapa (2003, 2008). In Nepal, the so-called lower caste (often called as occupational caste) groups are relatively deprived and have less access to resources on land, information, credit and education. Likewise, farm land located in *Terai* belt (the southern plain area) is found to have higher yields than in the northern Himalayan region of Nepal. This result is probably due to better land quality, combined with better access to markets and proximity to roads. The coefficient of agricultural extension services is significant and positive, implying that the households receiving agricultural extension services are more likely to increase farm productivity than the households without any agricultural extension services. This is probably due to better information about high yield seed varieties and new techniques for farm cultivation. However, the coefficients of consumer workers' ratio and age of household head do not show any significant impact on farm production.

This paper further estimated the translog production function (Table 4) and then calculated marginal products and factor shares for each input as its mean value in use from the estimated parameters. The linear terms of the translog production estimates are found to be significant except inorganic fertilizer expenditure and are mostly compatible with the results of Cobb-Douglas production function with some exceptions. The coefficient of land input is found to be highest influence on production process, followed by adult family female and adult male labour, and hired labour. However, only few interaction terms are found to be significant in the production function. For instance, the interaction of adult family male labour and hired labour has negative impact on

farm output. Likewise, the interaction terms of hired labour and farm land, adult family female labour and cash inputs, and hired labour and cash inputs are significant and have negative signs, implying that increase in the combination of these inputs is more likely to reduce farm output in Nepalese agriculture. However, the combined expenditure of fertilizers and other cash inputs has positive impact in farm output. Conclusively, the results from the interaction terms do not satisfy strong separability assumption, but there is little evidence of weak separability with adult family male and hired labour, adult family female and cash inputs. In other words, this result has little justification of aggregating labour input of both men and women, as explained by Kumar and Hotchkiss (1988).

Table 5 shows the results of marginal products and factor shares calculated from the translog production function, in which the aggregate factor share of labour input (0.56) is significantly higher than other factor inputs. However, the share of farm land (0.31) as a single input is much higher than other inputs. The share of market inputs, particularly inorganic fertilizers (0.06) and other cash inputs (0.06) is found to be relatively low in this result. The marginal product value of inputs except adult family male and female is found to be higher than prevailing wage rates and prices, implying that farmers are constrained by other inputs such as farm investment on fertilizers and seeds as well as hired labour. For instance, the marginal product of hired labour is Rs. 162.02 per day, which is significantly higher than the prevailing wage rate in the agricultural sector in Nepal, indicating that marginal products are not so comparable to the marginal products of inputs. This is somehow an indication of incomplete and missing factor markets in most resource-poor rural economies. On the other hand, the marginal product of adult family male and female labour seems to be lower than other inputs and prevailing wage rates in Nepal. The lower marginal products may be due to seasonal labour demand in farm sector and limited off-farm employment opportunities.

The marginal product of adult family male and female which is the main interest of this paper is found to be significant with different values, showing that the marginal product of adult family male labour (Rs. 5.04 per hour) is relatively higher than the marginal product of adult family female labour (Rs. 3.06 per hour), accepting the hypothesis of gender differential in farm productivity. This result contrasts with the result of Kumar and Hotchkiss (1988) for wheat, maize and mustard farms, but supports for early paddy farm.

This study also calculated the marginal products and factor shares for large and small farms (Table 6), and the results are found to be similar for factor shares, but some differences in marginal products. For instance, marginal products of labour, fertilizers and other cash inputs are found to be higher on large farms, while marginal product of land is significantly higher on small farms.

4. Conclusions

There is growing interest on academic arena about gender differentials in agricultural productivity, particularly in developing countries due to variation in resource accessibility between men and women as well as among ethnic groups. These variations and differences are often analysed with the theory of incomplete and missing markets, and other form of socio-cultural discriminations. This paper attempts to analyse the productivity of men and women in the Nepalese agriculture, using NLSS 2003/04 data. The study first estimated Cobb-Douglas production function with a dummy variable of female headed households and also applied translog production function, and then calculated marginal products and factor shares of agricultural production function.

This paper first calculates average inputs and output per hectare between male and female headed households separately. The result shows slightly higher average farm output per hectare in male in comparison to female headed households. Adult family male works higher on the farm land of male headed households, while female works more on the farm land of female headed households. For other inputs, female headed households hire more labour but apply less market inputs.

The results from Cobb-Douglas production function show that there is no significant effect between male and female headed households. Land is found to be higher effect on farm production process, followed by adult family male, adult family female, and hired labour. There is positive impact of market inputs such as fertilizers and other cash inputs on farm output, but lower than other inputs. Farm output is found to be higher on irrigated than non-irrigated land. Moreover, household characteristics such as households belonging to the so-called higher caste group, education level of household head, and land located on the southern plain area do matter on farm production process.

The results from translog production are mostly found to be compatible with Cobb-Douglas production function, particularly in linear terms. However, few interaction terms are significant in the model. For example, the interaction of the expenditure on fertilizers and other cash inputs has positive impact, while the interaction terms of hired labour and farm land, family female labour and cash inputs, and hired labour and cash inputs have negative impact on production process.

Factor shares calculated from translog production function show a higher share from farm land. However, aggregate factor share of total labour input is significantly higher than other inputs. The factor share of the expenditure on fertilizers and other cash inputs is relatively lower than other inputs. The marginal product value of other inputs is found to be higher than the existing market rates except family adult male and adult female, in which marginal product of adult family male and female shows a labour surplus in farm households, but households are constrained by other inputs.

Marginal products are relatively lower on small farm, but land input is found to be significantly higher on small farms.

Marginal products between adult family male and female which is the main interest of this study show a significantly different value, in which MP of adult family male is relatively higher than adult female. The separability test does not show significantly different results, but there is little support for weak separability, particularly family adult male and hired labour, family adult female and cash inputs.

Conclusively, though the findings do not clearly support the separability of gender differentials in the model, there is some justification of gender differentials in farm productivity and marginal products, combined with the differences in marginal products of small and large farms. The study further needs to be focused on plot level data managed by men and women separately. Based on the findings, policy needs to focus on the reduction of caste or ethnic disparities as well as regional imbalance in order to minimize disparities in farm productivity between men and women as well as among ethnic and caste groups.

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Appendixes

Table 1: Descriptive statistics of the study area

Variables	Description of variables	Mean	Standard Dev.
Farm income	Income from farm products plus sale of animal income & by other products)	14725.82	24116.69
Total land	Farmland both owned and sharecropped in hectare	0.91	1.06
Irrigated land	Ratio of irrigated land on total farmland	0.45	0.40
Male labour	Hours farm works on own farm (16+ years)	1786.44	1460.37
Female labour	Hours farm works on own farm(16+ years)	2017.97	1551.51
Hired labour	Work hours of hired and exchange labour	324.22	417.91
Total cash input	Expenditure on seed, irrigation, oxen and other machinery equipments	820.08	2550.12
Fertilizers	Expenditure on inorganic fertilizers	1400.30	2630.87
Household and location characteristics			
Sex of household head	Dummy: 1 if household head is	0.11	0.30
Head's age	Age of household head	46.32	19.51
Head's schooling	Years schooling of head	2.75	3.90
cwratio	Consumer-workers' ratio (adult /total family members)	0.56	0.22
Higher caste	Dummy: 1 if household is the so-called higher caste	0.35	0.48
Medium caste	Dummy: 1 if household is the so-called medium caste	0.48	0.49
Lower caster	Dummy: 1 if household is the so-called lower caste	0.17	0.38
Mountain	Dummy: 1 if household is located in mountain belt	0.14	0.35
Hills	Dummy: 1 if household is located in hilly belt	0.47	0.49
Terai	Dummy: 1 if household is located in *Terai* belt (the southern plain)	0.39	0.48

Source: NLSS 2003/04, CBS Nepal. Monetary values are in Nepalese currency.

Table 2: output, input use and farm credit per hectare

	Farm output	Cash input	Own male labour	Own female labour	Hired labour	Fertilizer	credit
Male	24617.05	843.66	3922.51	5105.42	217.01	2118.94	37794.70
Female	24598.51	764.77	1450.89	6857.97	226.80	1428.43	25256.80

Note: labour time is calculated in hours, while output and expenditure are in Nepalese currency (i.e. 1US$=NRs. 77.9)

Table 3: Estimation of Cobb-Douglas production function

Explanatory Variables	Estimated parameters	Standard Deviation
Gender(1=female)	-0.018	0.056
Log of total farm land in hectare	0.32***	0.023
Ratio of irrigated land	0.14***	0.046
Log of family male labour	0.077***	0.021
Log of family female labour	0.069***	0.023
Log of hired labour	0.050***	0.011
Log of fertilizer	0.022***	0.005
Log of other cash inputs	0.059***	0.004
Total number of livestock	0.012***	0.001
Consumer Worker's ratio	0.097	0.079
Education level of household head	0.01**	0.004
Age of household head	-0.001	0.002
Agricultural extension service(1=Yes)	0.38***	0.062
Caste dummy (1=higher)	0.34***	0.051
Caste dummy (1=medium)	0.079*	0.045
Hill dummy (1=hills)	0.11	0.047
Terai dummy (1=terai, southern plain)	0.097*	0.058
Constant	6.97***	0.213
R^2	0.51	
F(17, 2342)	120.74***	
Number of observations	2360	

***, **, * significant at 99%, 95%, and 90% levels respectively.

Table 4: Translog production function estimates

		Interaction terms				
Explanatory Variables	**Linear term**	**Ln (male labour)**	**Ln(female labour)**	**Ln(land)**	**Ln(hired labour)**	**Ln (fert)**
Log of family male labour	0.20*					
	(0.09)					
Log of family female labour	0.21*	0.007				
	(0.11)	(0.015)				
Log of total farm land in hectare	0.33**	-0.004	-0.015			
	(0.13)	(0.016)	(0.018)			
Log of hired labour	0.19**	-0.02**	-0.01	-0.02**		
	(0.07)	(0.008)	(0.009)	(0.007)		
Log of fertilizer	0.04	0.006	-0.002	0.009	-0.004	
	(0.056)	(0.005)	(0.007)	(0.006)	(0.002)	
Log of other cash inputs	0. 06*	-0.002	-0.008*	0.004	-0.003*	0.008***
	(0.03)	(0.004)	(0.004)	(0.004)	(0.002)	(0.001)
Constant	6.14***					
	(0.85)					
R^2						0.50
F(21, 2338)						111.01***
Number of observations						2360

Table 5: Marginal products and factor shares of inputs in farm production

Variables	Marginal products	Factor shares
Family male labour	5.04	0.19
Family female labour	3.06	0.19
Hired labour	162.02	0.18
Land	10125.3	0.31
Inorganic fertilizers	215.57	0.06
Other cash input	230.42	0.06

Table 6: Marginal products and factor shares of inputs on small and large farms

Variables	Large farms		Small farms[a]	
	Marginal products	Factor shares	Marginal products	Factor shares
Family male labour	5.08	0.20	3.81	0.20
Family female labour	4.09	0.19	2.20	0.19
Hired labour	204.77	0.18	140.43	0.19
Land	4885.23	0.31	12772.07	0.31
Inorganic fertilizers	280.76	0.06	182.64	0.06
Other cash input	326.60	0.06	181.84	0.06

a less than 0.92 hectares (average farm size in the sample households) are small farms.